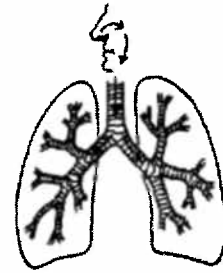


Name _____



Lung Capacity

Background Information: We need a constant supply of oxygen in order to stay alive. We use oxygen to break down food to release energy and produce carbon dioxide as a waste product. We need to continually take in oxygen from the air and expel carbon dioxide into the air.

The respiratory system functions to filter, warm, and humidify the air we breathe, and to supply cells with oxygen while removing carbon dioxide.

Air moves into the lungs through the trachea and then back out again. When each breath is completed, the lung still has some air, called the residual volume. Each inhalation adds additional air. Each exhalation removes about the same volume as was inhaled.

The amount (volume / capacity) of air in the lungs can be measured several ways:

- ☞ **TOTAL LUNG CAPACITY** (TLC) – the amount of air in the lungs after a deep *inhalation*; The vital capacity plus the residual volume
- ☞ **RESIDUAL VOLUME** (RV) – the amount of air left in the lungs after a deep *exhalation*
- ☞ **VITAL CAPACITY** (VC) – the amount of air exhaled in one breath; The maximum amount of air that can be forcibly exhaled after breathing in as much as possible.
- ☞ **TIDAL LUNG CAPACITY** – The amount of air your lungs hold during normal breathing; the amount of air moved in and out of the body in one breath

Lung volumes differ with age, sex, body frame and aerobic fitness.

Measuring your lung capacity can help you determine how much stamina you have available to go about your daily routine, include sports and other activities.

Usually you need about 1/3 of your lung capacity to carry out routine tasks that do not require exertion.

It is also possible for you to increase your lung capacity through regular exercise.

Your lung capacity may be affected by certain disorders such as asthma and emphysema.

Cigarette smoking will give you noticeable signs of emphysema after only three years of use. Such things as altitude, the position your body is in, air temperature, weather conditions, and air pollution may also contribute to a decrease in lung capacity.

Volume or capacity is measured in liters (l), milliliters (mL) and cubic centimeters (cm³). One mL is equal to one cm³.

Materials:

String
Round balloon

Meter stick
Calculator

Procedure:

1. Work with a partner.
2. Blow up the balloon several times to stretch before beginning to take measurements.
3. Take a deep breath, and blow up the balloon as much as you can with **ONE BREATH**. Hold the opening of the balloon closed with your fingers.
4. Use the string and ruler to measure the circumference (the distance around) the biggest part of the balloon. Record this number.
5. Repeat this 4 times, for a total of 5 trials.
6. Find the average circumference of the balloon. Record this number.
7. Find the **volume of the air** in the balloon by:
 - a. Calculating the **diameter** of the balloon –
Diameter = circumference ÷ π (3.14)

a = Diameter =

- b. Calculate the **radius** of the balloon –
Radius = diameter ÷ 2

b= Radius =

- c. Calculate the **volume** of the sphere –
Volume = radius³ X π X 3/4
 $r^3 \times \pi \times 4/3$

or

$$\frac{r \times r \times r \times 3.14 \times 3}{4}$$

c = Volume =

Data:

Circumference of Balloon in Centimeters						
Trial	1	2	3	4	5	Average Circumference
Circumference						

Diameter of Balloon (cm)	Radius of Balloon (cm)	Volume of Air (cm ³ or mL)	Volume of Air (L) = mL ÷ 1000

The volume you have calculated is your **experimental lung capacity** – it is the amount of air your lungs *actually* held.

Your **Vital Capacity** is the amount of air you *should be able* to hold considering your height and age. To find your vital capacity:

☞ Find your height in centimeters:

☞ Now, use this formula:

$$\text{Vital Capacity} = 0.041 \times \text{height in cm} - 0.018 \times \text{age} - 2.69$$

Your **Vital Lung Capacity** is _____

Data Analysis:

1. How does your *experimental lung capacity* compare to your *vital lung capacity*?

2. What might account for any differences in the capacities?

3. Compare your vital lung capacity with the capacities of the students sitting near you. Are they same? Explain your answer.

Conclusion:

1. Describe **lung capacity** in your own words:

2. Athletes have to be in very good condition. What type of athlete would you think would have the largest lung capacity? Explain your answer.

Design an investigation to test **one** of the following:

- ☞ Do you think the air temperature will have an effect on the lung capacity of an individual?
- ☞ Will a person's height and/or size have an effect on their lung capacity?
- ☞ How does a smoker vs. nonsmoker compare for lung capacity?

1. Write a step-by-step procedure for the investigation.
2. Create a chart to record the type of data you would collect in your investigation.
3. Write your procedure & chart on a sheet of notebook paper and staple it to the back of this lab.